



Environmental Protection Department

Environmental Restoration Program and Division

Site Safety Plan for Lawrence Livermore National Laboratory CERCLA Investigations at Site 300

November 2000



Lawrence Livermore National Laboratory

University of California Livermore, California 94550

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for
Lawrence Livermore National Laboratory
CERCLA Investigations
at Site 300**

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Site 300 Manager

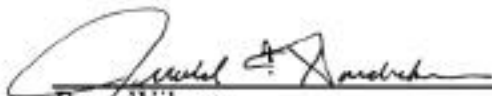
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Table of Contents

Foreward.....	Forward-i
1. Emergency Contacts.....	1-1
2. General Information and Policies.....	2-1
3. Summary of Background Information.....	3-1
4. Organization, Responsibilities, and Authority.....	4-1
4.1. Organization.....	4-1
4.2. Responsibilities.....	4-2
4.2.1. Site Safety Officer (SSO).....	4-2
4.2.2. Environmental, Safety, and Health (ES&H) Coordinator.....	4-3
4.2.3. Quality Assurance (QA) Implementation Coordinator.....	4-4
4.2.4. Authorizing Individual.....	4-4
4.2.5. Responsible Individual.....	4-5
5. Medical Screening Program.....	5-1
6. Hazard Evaluation.....	6-1
6.1. Chemical Hazards.....	6-2
6.1.1. Benzene.....	6-3
6.1.2. Beryllium.....	6-3
6.1.3. Diesel.....	6-3
6.1.4. Gasoline.....	6-3
6.1.5. HMX.....	6-4
6.1.6. Hydrochloric acid.....	6-4
6.1.7. Lead.....	6-4
6.1.8. Nitric acid.....	6-4
6.1.9. RDX.....	6-5
6.1.10. Tetrachloroethylene.....	6-5
6.1.11. Trichloroethylene.....	6-5
6.1.12. Toluene.....	6-5
6.1.13. Tritium.....	6-6
6.1.14. Natural and Depleted Uranium.....	6-6
6.1.15. Xylene.....	6-7

6.2. Biological Hazards.....	6-7
6.3. Physical Hazards.....	6-7
6.4. General Safety Hazards.....	6-10
6.5. Hazards to Non-Project Personnel.....	6-11
7. Emergency Actions.....	7-1
7.1. Planning.....	7-1
7.2. Emergency Services.....	7-1
7.3. Evacuation.....	7-1
7.4. Emergency Evacuation From Contaminated Areas.....	7-1
7.5. First Aid.....	7-2
7.6. Fire.....	7-2
7.7. Hazardous Materials Spill.....	7-2
7.8. Guidelines.....	7-2
8. Personal Protective Apparel and Equipment.....	8-1
8.1. Personal Protection.....	8-1
8.2. Apparel Decontamination.....	8-3
8.3. Equipment Decontamination.....	8-3
8.4. Personnel Decontamination and Personal Hygiene.....	8-4
8.5. Monitoring Equipment.....	8-4
8.5.1. Monitoring Rationale.....	8-4
8.5.2. Equipment.....	8-4
8.5.3. Initial Monitoring.....	8-5
8.5.4. Periodic Monitoring.....	8-5
8.5.5. High Risk Employees.....	8-6
8.5.6. Perimeter Monitoring.....	8-6
8.6. First Aid and Safety Equipment.....	8-6
9. Personnel Training.....	9-1
9.1. Hazardous Waste Operations and General Safety Requirements.....	9-1
9.2. Work Site Specific Topics.....	9-2
9.2.1. Prohibited Practices.....	9-2
9.2.2. Emergency Procedures and Services.....	9-3
9.2.3. General Safety Requirements.....	9-4

9.3. Field Briefings.....	9-4
9.4. First Aid.....	9-5
10. Operations.....	10-1
10.1. Work Site Practices.....	10-1
10.2. Work Zones.....	10-1
10.2.1. Exclusion Zone.....	10-1
10.2.2. Contamination Reduction Zone.....	10-1
10.2.3. Support Zone.....	10-2
10.3. Security Measures.....	10-2
10.4. Hazard Control Measures.....	10-2
10.5. Fire Protection.....	10-3
10.6. Communications.....	10-3
10.7. Personnel Protection Plan.....	10-3
10.8. Safety.....	10-4
10.9. Recordkeeping.....	10-4
11. Bibliography.....	11-1

Figures

Figure 1. Site 300 Restoration Program and Division organizational chart.....	1-3
Figure 2. Environmental restoration activities and the extent of ground water contamination at LLNL Site 300.....	3-3

Appendices

Appendix A. Site-Specific Operational Safety Procedures
Appendix B. Acronyms
Appendix C. Material Safety Data Sheets
Appendix D. Trench and Excavation Safety
Appendix E. Electrical Safety
Appendix F. Levels of Personal Protection
Appendix G. DOE Explosives Safety Manual Waiver

Foreward

This Site Safety Plan (SSP) for the Environmental Restoration Division's (ERD) environmental operations has been prepared on the basis of available data specifically for the Lawrence Livermore National Laboratory (LLNL) Site 300 located 15 miles east of Livermore, California. This SSP was written to comply with applicable requirements of Occupational Safety and Health Administration regulations, including 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response and incorporates guidance from the LLNL Hazards Control Department. This document is intended as a general health and safety plan that supplements LLNL's primary Environment, Safety, and Health (ES&H) Manual in accordance with LLNL's "Integrated Safety Management System" (ISMS) for ERD employees and subcontractors. It is the responsibility of the ERD Site 300 Safety Officer (SSO) to evaluate data utilizing ISMS that may impact health and safety during these activities and to modify the SSP and ISMS documents such as Integrated Work Sheets (IWSs) as appropriate. The SSO shall have the authority to institute any changes that provide greater health and safety protection for workers at Site 300.

1. Emergency Contacts

This may be updated as necessary to reflect current personnel, telephone numbers, positions and any other outdated information.

Local Contacts for All Emergencies

From Lawrence Livermore National Laboratory (Site 300) phones **911**

Offsite Emergency Response **(925) 447-6880**

Hazardous Materials Information

Toxline (301) 496-1131

CHEMTREC (24-hour, emergency only) (800) 424-9300

ORNL, Toxicology Information Response Center (615) 576-1743

Data Access

Current safety documents and reference materials can be located in the Environmental Restoration Program and Division (ERD) Office.

LLNL Contacts

John Ziagos, ERD Site 300 Project Leader (925) 422-5479

John Kilmer, ERD Site 300 Site Safety Officer (SSO) (925) 423-3445

Beeper (925) 423-7705-00921

Greg Santucci, ERD Site 300 SSO–Backup (925) 423-5043-23089

Beeper (925) 423-7705-06502

Jerry Bardecker–ES&H Team 1 Deputy Division Leader (925) 423-6150

Site 300 Organizational Structure

Figure 1 is a general organizational chart for the Environmental Restoration Program and Division Site 300 Project.

Standard Procedures for Reporting Emergencies

When calling **911** (447-6880 cell phone) for assistance in an emergency situation, the following information should be provided:

1. Name of person making call.
2. Telephone number and location of person making call.

3. Name of person(s) exposed or injured and location.
4. Nature of emergency and type of exposure, when appropriate.
5. Actions already taken.

Never hang up first when calling for emergency assistance. Wait for the dispatch operator to finish all questions.

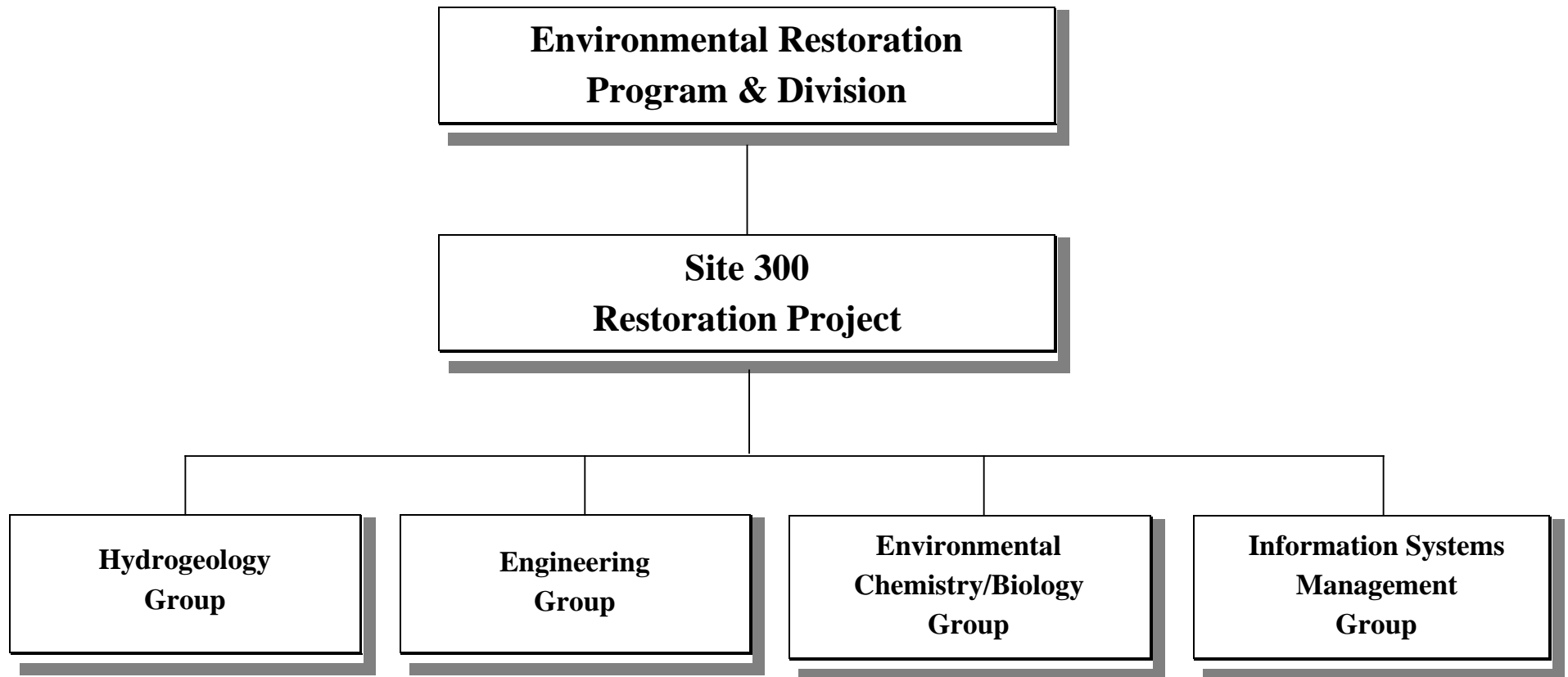


Figure 1. Site 300 Restoration Program and Division organizational chart.

2. General Information and Policies

The safety policy of LLNL is to take every reasonable precaution in the performance of work to protect the environment and the health and safety of employees and the public, and to prevent property damage. With respect to hazardous agents, this protection is provided by limiting human exposures, releases to the environment, and contamination of property to levels that are as low as reasonably achievable. It is the intent of this Site Safety Plan (SSP) to supply the broad guidance to ERD employees and subcontractors for completing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) environmental investigations. It may not be possible to determine actual working conditions in advance of the work; therefore, Integrated Safety Management System (ISMS) principles and functions will be utilized to provide a range of protection based upon actual working conditions. Requirements will ensure that work can be completed in a safe, efficient, and timely fashion.

Due to the relatively large size of Site 300 and the different types of activities underway, site-specific Integration Work Sheets (IWSs), Operational Safety Plans (OSPs), and Standard Operating Procedures (SOPs) may be prepared to supplement activities not covered by this SSP or the LLNL Environment, Safety, and Health (ES&H) Manual. These site-specific IWSs and OSPs provide the detailed information for each specific activity and act as an addendum to this SSP, which provides the general plan for ERD Site 300 operations.

ERD employees and subcontractors working at LLNL must follow the policies set forth in this SSP, as well as LLNL and the U.S. Department of Energy (DOE) policies, procedures, and instructions. Of special value are the *LLNL ES&H Manual* (Hazards Control Department, 2000) and support provided by the LLNL Hazards Control Safety Teams. Subcontractors must have their own health and safety procedures and training, which address operations that fall under the respective subcontracts, which may be modeled after those provided by LLNL. These procedures must be reviewed and approved by the SSO, or a designee, prior to the initiation of work.

Each time the term SSO is used, either the SSO or a designee should take responsibility or complete the action.

Employees are obligated to halt work and bring to the attention of the Responsible Individual (RI) and their supervisor any unsafe or hazardous condition that they observe as they carry out their responsibilities. The supervisor shall inform the SSO promptly so that the situation can be corrected and personnel can be advised of an improved procedure. The improved procedure will be incorporated into the IWS by the RI and the Authorizing Individual will be notified. It is impossible to anticipate all specific safety and health hazards beforehand; therefore, all personnel must exercise common sense and good judgment in their approach to a given situation. Each person is ultimately responsible for their own safety and the safety of others working with or near them.

The Health and Safety Training described in Section 9 of this document will assist in preparing individuals to recognize hazards. All personnel potentially exposed to physical or chemical hazards as described in this SSP shall follow the safety and health procedures set forth herein, and the IWSs, OSPs (Appendix A), and SOPs pertaining to the activity they are engaged in.

Any modifications to this SSP will be issued as attachments to this document.

3. Summary of Background Information

LLNL operates the Site 300 Experimental Test Site in support of the DOE Stockpile Stewardship and Management Program and other non-defense programs. The principal activity of the site is to perform tests on the high explosives component of stockpile weapons systems. Site 300 is located in the eastern Altamont Hills about 15 miles southeast of LLNL and 65 miles southeast of San Francisco.

The DOE is required to maintain an environmental protection program and has implemented the CERCLA through DOE Order 5480.14. The responsibility for conducting environmental restoration of Site 300 is vested in the LLNL Site 300 Restoration Project, which is part of LLNL's Environmental Protection Department, Environmental Restoration Program and Division. Regulatory oversight is provided by the U.S. Environmental Protection Agency (EPA), the California Department of Toxic Substances Control (DTSC), and the California Regional Water Quality Control Board-Central Valley Region (RWQCB-CV).

Since 1982, LLNL has conducted a series of investigations to identify areas of soil, rock, and ground water contamination. The goal has been to remediate those areas to bring Site 300 into compliance with Federal, State, and local regulations. Seven operable units have been designated at Site 300 which correspond to areas containing ground water contamination (Fig. 2). An eighth operable unit has also been designated to cover areas still requiring investigation or require ongoing monitoring.

Analytical results from various sampling activities and quarterly ground water monitoring have identified the presence of various contaminants. Volatile organic compounds (VOCs) have been found at varying concentrations in the parts-per-billion (ppb or $\mu\text{g/L}$) range, with trichloroethylene levels approaching parts-per-million (ppm or mg/L) concentrations. Tritium in ground water has been found at activities of up to 2,600,000 picocuries per liter (pCi/L) and 16,000,000 pCi/L in soil moisture. HE compounds have been identified at concentrations of up to 350 ppb ($\mu\text{g/L}$) in ground water and 18 ppm (mg/kg) in soil. Depleted uranium in soil has been found at activities of up to 141 pCi/gram (g). Lead and beryllium have been detected at very low ppm (mg/L) concentrations in ground water.

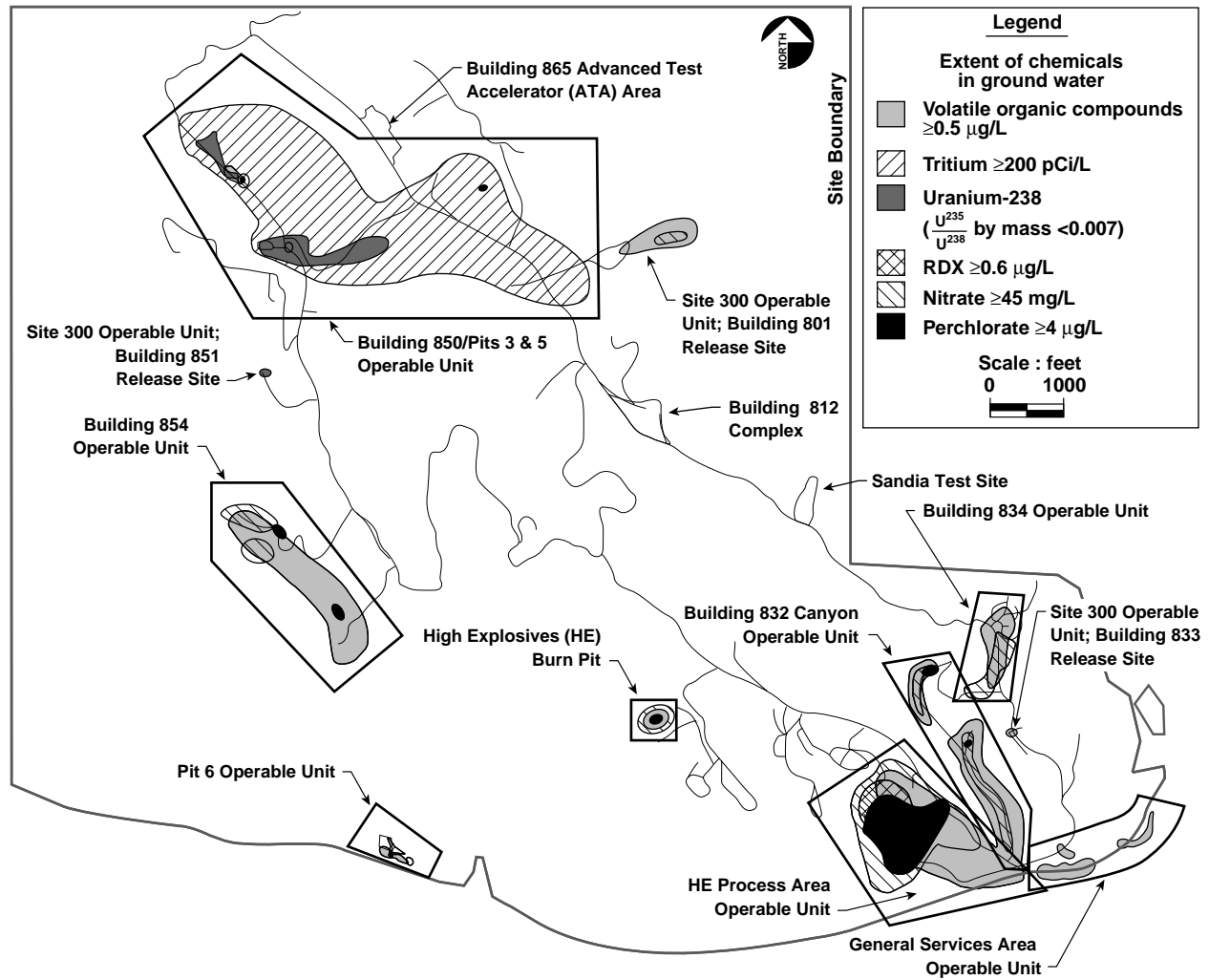
On the basis of analytical results, the substances present in environmental media at Site 300 include:

- Trichloroethylene (TCE),
Tetrachloroethylene (PCE), and other
related VOCs
- Beryllium.
- Lead and other metals.
- Natural and depleted uranium.
- PCBs.
- Dioxins.
- Perchlorate.
- Nitrate.
- HMX [octahydro-1,3,5,7-tetranitro-
tetrazocine].
- RDX [hexahydro-1,3,5-trinitro-1,3,5-
triazine.
- Tritium.
- Diesel and gasoline hydrocarbons.

Other work activities may pose potential exposures or problems due to:

- Fuel Hydrocarbons:
 - Benzene
 - Gasoline
 - Toluene
 - Xylene
- Heavy equipment
- Noise
- Nuisance dust
- Snake bite
- Temperature extremes:
 - Heat stress
 - Cold exposure
- Unknown materials previously disposed of in landfills
- Valley Fever
- Off-road driving
- Slips/trips/falls

This SSP in conjunction with ISMS addresses health and safety issues related to the various tasks and phases for the environmental work planned and ongoing at Site 300. Technical issues and specifications for the scope of work are presented in the specific Work Smart Standards (WSSs), Quality Assurance Plan, Work Plans, Closure Plans, and in the ERD Standard Operating Procedures manual, which are available for ready reference in the ERD Quality Assurance Office. The SSO should review these documents in order to correctly carry out assigned responsibilities and to assist in presenting pertinent health and safety concerns to site workers.



ERD-S3R-00-0142

Figure 2. Environmental restoration activities and the extent of ground water contamination at LLNL Site 300.

4. Organization, Responsibilities, and Authority

4.1. Organization

Key ERD personnel are listed below by name, title, address, and telephone number.

Albert L. Lamarre
ERD Division Leader
L-544, P.O. Box 808
Lawrence Livermore National Laboratory
Livermore, CA 94551
(925) 422-0757

Judy Steenhoven
ERD Deputy Division Leader
L-544, P.O. Box 808
Lawrence Livermore National Laboratory
Livermore, CA 94551
(925) 423-8853

John P. Ziagos
ERD Site 300 Project Leader
L-544, P.O. Box 808
Lawrence Livermore National Laboratory
Livermore, CA 94551
(925) 422-5479

John M. Kilmer
ERD Site 300 Site Safety Officer
L-843, P.O. Box 808
Lawrence Livermore National Laboratory
Livermore, CA 94551
(925) 423-3445

The ERD Division Leader has ultimate authority over the overall operations of the site. He approves changes in the scope of the operations, schedules, etc.

The Site 300 Project Leader has ultimate authority over the overall operation of the site in the absence of the Division Leader. He also has the responsibility to ensure that all operations are conducted by the SSO in accordance with this SSP.

ES&H activities are important during all phases of any project. The degree of implementation of the activities or services is related to the perceived risk. The SSO shall have the responsibility to determine health and safety needs for this project and the authority to ensure that appropriate measures are taken. All ERD personnel shall comply with the requirements of this SSP and cooperate with project management in its implementation. It is the responsibility of all site personnel after taking appropriate measures (i.e., contacting 911, securing the area or equipment, etc.) to immediately report any of the following to the SSO:

- A. All accidents or injuries.

- B. Unsafe or malfunctioning equipment.
- C. Any symptoms or signs of chemical exposure.
- D. Unexpected or uncontrolled releases of potentially hazardous materials.
- E. Unauthorized personnel entry onto the site.
- F. Any changes in the site conditions which might adversely affect the health and safety of personnel.

4.2. Responsibilities

4.2.1. Site Safety Officer (SSO)

The ERD SSO is responsible for:

- a. Interfacing with ERD personnel to promote ISM safety awareness and safe working practices.
- b. Determining health and safety needs for the work site and implementing the safety controls contained in the applicable plans and procedures.
- c. Ensuring that work areas are kept clean and orderly to control potential general safety hazards and that personnel adhere to established procedures.
- d. Requiring specific health and safety precautions prior to work site entry by ERD and subcontract personnel, such as safety orientations.
- e. Ensuring that proper personnel protective (PPE) equipment are available and worn by personnel, and that PPE and other equipment are maintained and properly stored.
- f. Monitoring ERD and subcontractor operations for the existence of hazardous conditions, and monitoring personnel for signs of exposure, heat stress, fatigue, etc. and ordering the immediate evacuations from any work site when conditions posing an unacceptable risk arise through the course of work.
- g. Evaluating results of the monitoring program and determine its impact on future operations.
- h. Informing the Project Leader and Hazards Control Department of any health and safety conditions that may adversely affect the project.
- i. Verifying that all required safety training is completed and documented.
- j. Knowing LLNL's emergency procedures and contacts.
- k. Ensuring that environmental and personnel monitoring operations are ongoing and carried out in accordance with technical specifications, procedures, and project instructions.
- l. Implementing the DOE Explosives Safety Manual Waiver 00-07 with the Ground Water Sampling Coordinator. A copy of the waiver is attached in Appendix G.

The SSO shall immediately inform the Site 300 Project Leader of any health and safety conditions that may adversely affect the project.

The SSO, or designee, has the authority to:

- Obtain information and assistance from the Hazards Control Department or other appropriate support as warranted.
- Require specific health and safety precautions prior to work site entry by ERD and subcontract personnel, and ensure that personnel adhere to requirements of this SSP.
- Require any ERD or subcontract employee to obtain immediate medical attention in case of an injury or illness.
- Deny ERD and/or subcontract personnel access to any ERD work site.
- Establish an area where personnel are to gather if there is an evacuation from the work zone.
- Stop work and order the immediate evacuation of ERD and/or subcontract employees from any work site when hazardous conditions arise in the course of work.
- Permit visitors (i.e., anyone other than an ERD or subcontract employee) at work sites only at the direction of, and with the permission of the Responsible Individual (RI).
- Monitor site conditions during operations to determine whether any changes in work zones or personnel protection are required.
- Ensure that work areas are kept clean and orderly to control potential general safety hazards.

The SSO will review and update this SSP every three years or as necessary to ensure that the SSP still reflects current ERD operations and organizational structure. The review will reflect changes in technology, operation, contamination, etc. The SSO or designee will also conduct work site safety briefings to cover the contents of this SSP, relevant OSPs, Integrated Work Sheets (IWSs), safe work practices, PPE use, and emergency procedures.

All ERD and subcontract personnel assigned to this project are responsible for following this SSP, ISMS requirements using safe work practices, and wearing the PPE specified by the SSO. The SSO or designee shall inform all subcontractors of emergency response procedures and known hazards of the operations prior to site entry. Project personnel shall report hazards and unsafe conditions and practices to their supervisor and the SSO. Project personnel must comply with all Federal and State OSHA local health and safety regulations, as well as the *LLNL ES&H Manual*.

The ES&H Team 1 Division Leader (Hazards Control Department) provides an interface between the members of Hazards Control and ERD. The health and safety professionals and technicians assigned to ERD provide support and technical services to the SSO or designee as requested and required by LLNL policy.

4.2.2. Environmental Safety and Health (ES&H) Coordinator

The ERD ES&H Coordinator is responsible for:

- a. Coordination of ES&H activities within ERD.
- b. Providing guidance to ERD personnel in meeting ES&H and DOE Conduct of Operations requirements.
- c. Maintaining direct communication and liaison with the EPD Quality Assurance (QA) Office and Division Leader for the implementation of ES&H requirements within ERD.

- d. ES&H document preparation and review such as Operational Safety Procedures (OSPs), Operations and Maintenance (O&M) manuals.
- e. Maintaining ERD's Deficiency Tracking system (DefTrack).
- f. Planning and scheduling of ES&H walkthroughs, assessments, reviews, and surveillances of ERD facilities by external agencies (i.e., DOE and regulators) and internal teams (i.e., Hazard Control, Plant Operations Directorate, and EPD).
- g. Conducting audits and assessments of ERD's compliance with ES&H requirements.
- h. Assisting with the implementation of corrective actions to ES&H deficiencies.
- i. Reviewing and critiquing draft DOE orders (i.e., occurrence reporting, facility maintenance programs), and LLNL's implementation of these Orders.
- j. Tracking the application and expiration dates of treatment facilities permits, such as air and water discharge permits.

4.2.3. Quality Assurance (QA) Implementation Coordinator

The ERD QA Implementation Coordinator is responsible for:

- a. Coordination of QA program implementation activities within ERD.
- b. Providing guidance to ERD personnel in meeting QA Program requirements.
- c. Maintaining direct communication and liaison with the EPD QA Office and Division Leader for the implementation of the QA Program within ERD.
- d. QA document preparations such as, Project Quality Assurance Project Plan (QAPPs) and Annual QA Reports to ERD management.
- e. Tracking and maintaining controlled documents and distribution lists.
- f. Ensuring Standard Operating Procedures (SOPs) are developed to direct ERD activities.
- g. Reviewing and concurring to all procedures for activities affecting quality to ensure conformance to EPD Quality Assurance Management Plan (QAMP) requirements.
- h. Tracking Quality Improvement Forms (QIFs) that document corrective actions for adverse conditions.
- I. Maintaining database tracking system for all assessment, audits, and inspections.
- j. Performing/overseeing self-assessments of ERD activities and developing self-assessment schedules.
- k. Continually working to improve ERD processes.

4.2.4. Authorizing Individual

The person designated by an authorizing organization who is responsible for a work activity's technical, financial, administrative, and ES&H objectives. Also the individual authorized by the associate director (or his/her designee) to accept and manage, on the Laboratory's behalf, the risks associated with the work activity. This person authorizes the work to proceed only after all controls are implemented and confirmed.

4.2.5. Responsible Individual (RI)

The individual directly responsible for an operation, activity, or group of activities. The RI may be at any level within the organization and is formally identified by the activity's authorizing individual. In some organizations, this person is called the work supervisor. In most cases the RI will be directing the work of others as part of the operation or activity. Examples of RI job titles include supervisor, division leader, group leader, project leader, project engineer, principal investigator, facility manager, building coordinator, lead experimenter, and lead technician.

5. Medical Screening Program

The purpose of the medical screening program is to assess the health status of personnel prior to work, monitor personnel for evidence of post-project adverse health effects, and determine the suitability of individuals for future work assignments of this type. All personnel who will be working on this project must undergo a medical evaluation before participating in these operations. If the SSO determines that significant exposure to hazardous materials is encountered in these operations, a follow-up medical exam shall be conducted on the exposed individuals.

Baseline and periodic health assessments for project personnel shall be consistent with LLNL requirements and OSHA regulations prescribed in 29 CFR 1910, especially those in 1910.120, *Hazardous Waste Operations and Emergency Response*.

At a minimum, the examination should include:

- Medical and organizational histories.
- Physical examination.
- Vision test.
- Urinalysis.
- Blood chemistry panel and complete blood count.
- Pulmonary function tests and respirator use clearance.

Optional tests include:

- X-rays.
- Electrocardiograms.
- Bioassays for specific compounds, if recommended by the examining physician due to previous or expected exposures.
- Hearing.

Due to the low risk of acute exposure, additional medical monitoring specific to this project is not anticipated.

If an individual has completed an occupational medical exam within the past 12 months, the *examining physician* may determine that another complete exam is unnecessary.

In addition to the medical screening program, a medical surveillance program will be provided by ERD for its employees when one or more of the following items are applicable:

- A. All employees who are or may be exposed to airborne levels of hazardous substances above OSHA Permissible Exposure Limits (PEL) or, in the absence of PEL, other published exposure limits, without regard to the use of respirators, for 30 days or more per year.
- B. All those who use a respirator for 30 or more days per year or are required to do so under 29 CFR 1910.134 Respiratory Protection.

- C. All employees who are injured due to overexposure from an emergency incident involving hazardous substances or health hazards.

Employees covered by the medical surveillance program will be given medical examinations and consultations at the following frequency:

- A. Prior to assignment.
- B. Annually unless attending physician extends the interval up to 2 years or decreases the interval as medically necessary.
- C. At termination of employment or reassignment to another area where employee will not be under medical surveillance if the employee has not had an examination within the last 6 months.
- D. As soon as possible after development of signs or symptoms indicating overexposure to hazardous substances above PEL or other published exposure levels in an emergency situation.

Medical examinations will include a medical and work history (or updated history if one is in the employee's file) with special emphasis on: symptoms related to the handling of hazardous substances, health hazards of these substances, and fitness for duty, including the ability to wear any required PPE under the conditions (i.e., temperature extremes) that may be expected at the work site. All medical examinations and procedures shall be performed by or under the supervision of a licensed physician.

The attending physician will be provided with the following information by the SSO or supervisor in conjunction with Hazards Control:

- A. A description of the employee's duties as they relate to employee's exposures.
- B. The employee's exposure levels or anticipated exposure levels.
- C. A description of any personal protective equipment used or to be used. If respirators are to be worn, then information will be provided concerning the type, anticipated periods of use, workloads, etc., as required by 29 CFR 1910.134.
- D. Where feasible, information from previous medical examinations of the employee that is not readily available to the examining physician.
- E. A copy of this SSP and its appendices.

LLNL Health Services will provide each covered employee with a written opinion from the attending physician containing the following:

- A. A summary of the results of the examination.
- B. An opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of impairment of the employee's health from work in hazardous waste site operations or from the use of respirators. The written opinion shall not reveal specific findings or diagnoses unrelated to occupational exposure.
- C. Any recommended limitations upon the employee's assigned work.
- D. Any medical conditions which require further medical examination or treatment.

An accurate record of the medical surveillance required by this standard shall be retained in accordance with 29 CFR 1910.20. The record shall include at least the following items:

- A. Employee's name and social security number.
- B. Physician's written opinion, recommended limitations, and results of examinations and tests.
- C. Any employee medical complaints related to exposure to hazardous substances.
- D. A copy of the information provided to the examining physician by the employer with the exception of the standard and its appendices.

Employees who may be exposed to chemical hazards while performing project work must receive medical screening. LLNL will screen at-risk LLNL employees, and contract firms will screen their at-risk employees, as specified in their contracts with LLNL and DOE.

6. Hazard Evaluation

There are potential hazards associated with the environmental investigations of the LLNL Site 300. These include:

Chemical Hazards

- Benzene
- Beryllium
- Diesel
- Gasoline
- HMX
- Hydrochloric acid
- Lead
- Nitric acid
- RDX
- Tetrachloroethylene
- Trichloroethylene
- Toluene
- Tritium
- Depleted uranium
- Natural uranium
- Xylene

Biological Hazards

- Snake bite
- Valley Fever

Physical Hazards

- Heavy equipment (drill rigs, air compressors, backhoe, crane).
- Excavations
- Overhead power lines
- Underground utilities
- Confined space entry
- Fire and explosion
- Electrical hazards
- Noise
- Heat stress
- Frostbite and hypothermia

General Safety Hazards

Hazards to Non-Project Personnel

6.1. Chemical Hazards

The chemicals or substances listed above as chemical hazards may enter the body through inhalation, skin absorption, or ingestion. These chemicals may enter by more than one route, may cause damage at the point of entry, or may cause organ damage after being metabolized.

The operations on some sites may involve the use of hazardous substances used in the operations or stored onsite. For example, hydrogen peroxide (50%), which is a strong oxidizer, may be used at some sites to treat ground water contamination.

The SSO and/or site supervisor will ensure that all site employees are trained in accordance with 29 CFR 1910.1200, Hazard Communication and the *LLNL ES&H Manual Supplement 7.02* (formerly 1.02).

Exposure limits, detectable limits, and other references to airborne chemical concentrations given below are for vapors or particulates in air. Concentrations encountered in soil and ground water are generally several orders of magnitude lower than the limits specified here. Therefore, even direct contact with soil and ground water and exposure to associated contaminants is unlikely to produce acute exposures.

The respiratory hazards associated with work activities are exposure to vapors, gases, and/or particulates such as dusts during drilling, well installation, tank excavation, decontamination, and other operations. It is not anticipated that exposure levels in excess of recommended permissible exposure limits (PELs) or threshold limit values (TLVs) will be encountered. However, precautions must be taken to minimize dust generation during work activities that contain toxic compounds such as lead or beryllium. This may require spraying the work area with water in sufficient amounts to control dust. The open-air environment at the site should provide adequate ventilation to reduce potential respiratory hazards to very low or negligible levels. Dermal hazards result from direct contact of solids, liquids, or vapors with the skin. Since the potential for vapor contact is low, dermal hazards from vapors are expected to be negligible. Direct contact with contaminated soil and ground water in the field would not generally result in dermal effects. Acids used for sample preservation are corrosive to the skin, eyes, and respiratory tract. Therefore, good hygienic practices, and the fact that these chemicals may be absorbed through the skin or are corrosive, warrant protecting the skin.

Based upon previous experience at this site, it is anticipated that direct skin contact is unlikely to occur if protective clothing and/or protective equipment is used as specified in Section 8.

To prevent ingestion of hazardous or toxic materials, workers should wash their hands prior to eating, drinking, smoking, or using restroom facilities.

Abbreviations and acronyms relating to exposure limits are provided in Appendix A. Readily available Material Safety Data Sheets (MSDSs) are provided in Appendix B. All MSDSs are available through the LLNL internal home page Grapevine under ES&H Resources, or call the MSDS Hotline at Extension 4-4404.

6.1.1. Benzene

Odor: Aromatic; odor threshold, approximately 4.7 ppm.

Fire Potential: Dangerous; when exposed to heat or flame can react vigorously with oxidizing materials.

Flammable Limits—LFL 1.3%, UFL 7.9%.

Explosive Limits—LEL 1.3%, UEL 7.1%.

Exposure: Irritating to eyes, nose, and throat. Suspected human carcinogen. **Symptoms:** dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction, loss of consciousness.

OSHA PEL: TWA, 1 ppm; STEL, 5 ppm.

ACGIH TLV*: TWA, 10 ppm; IDLH, 2,000 ppm.

6.1.2. Beryllium

Fire Potential: Combustible; poisonous gases may be produced in fire.

Exposure: Dust is extremely toxic when inhaled. **Symptoms:** coughing, shortness of breath, acute or chronic lung disease. Any dramatic, unexplained weight loss should be considered as first indication of beryllium disease.

OSHA PEL: TWA, 2 $\mu\text{g}/\text{m}^3$; Ceiling, 5 $\mu\text{g}/\text{m}^3$; Max. peak, 25 $\mu\text{g}/\text{m}^3$ for 30 min.

ACGIH TLV: TWA, 2 $\mu\text{g}/\text{m}^3$; suspect human carcinogen.

Note: DOE is considering lowering PEL for beryllium to 1.0 $\mu\text{g}/\text{m}^3$.

6.1.3. Diesel

Odor: Characteristic of petroleum distillate.

Fire Potential: Flash point 185°C; fire hazard greater if liquid temperature exceeds 85°F; may explode if pressure is used to empty drums.

Exposure: Irritating to eyes, nose, and throat; central nervous system depressant if inhaled. **Symptoms:** headache, dizziness, loss of appetite, weakness, and loss of coordination. Incomplete combustion produces carbon monoxide; toxic fumes may accumulate.

ACGIH TLV: Not established. Reduce exposure to lowest feasible level.

6.1.4. Gasoline

Odor: Characteristic of gasoline; odor threshold, 0.25 ppm.

Fire Potential: Flammable; flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area.

* TLV may be reduced to 0.1 ppm.

Flammable Limits—LFL 1.4%, UFL 7.4%.

Exposure: Irritating to eyes, nose, and throat. Symptoms: irritation of mucous membranes, dizziness, headache, incoordination, anesthesia, coma.

ACGIH TLV: TWA, 300 ppm; STEL, 500 ppm.

6.1.5. HMX (*Synonym:* Octogen)

Fire Potential: Moderate, by spontaneous chemical reaction.

Exposure: Irritation of eyes and respiratory tract.

DOT-Hazard: Cannot be shipped in a dry state.

6.1.6. Hydrochloric Acid

Odor: Pungent; sharp.

Fire Potential: Not flammable. Flammable hydrogen gas may be formed on contact with metals.

Exposure: Irritating to eyes, nose, and throat. Severe skin irritant.

OSHA PEL: Ceiling, 5 ppm for 15 min.

ACGIH TLV* : Ceiling, 5 ppm.

IDLH: 100 ppm.

6.1.7. Lead

Exposure: Lead is a potent, systemic poison. Chronic exposure may result in damage to blood-forming, nervous, urinary, and reproductive systems.

OSHA PEL: TWA, 50 $\mu\text{g}/\text{m}^3$.

ACGIH TLV: TWA, 0.15 mg/m^3 .

6.1.8. Nitric Acid

Odor: Acrid; sweet to acrid.

Fire Potential: Not flammable; may cause fire on contact with combustibles. Flammable hydrogen gas may be formed on contact with metals.

Exposure: Corrosive to tissue, may cause severe burns to eyes and skin. Irritating to eyes, nose, and throat. May also release toxic oxides of nitrogen (NO_x) gas.

OSHA PEL: TWA, 2 ppm; STEL, 4 ppm.

ACGIH TLV: TWA, 2 ppm; STEL, 4 ppm.

IDLH: 100 ppm.

* TLV may be reduced to 50 $\mu\text{g}/\text{m}^3$.

6.1.9. RDX (Synonym: Cyclonite)

Fire Potential: Moderate, by spontaneous chemical reaction.

Exposure: Irritation of eyes and respiratory tract. May be absorbed through intact human skin.

ACGIH TLV: TWA, 1.5 mg/m³.

6.1.10. Tetrachloroethylene (PCE)

Odor: Ether-like; odor threshold, 5 ppm.

Fire Potential: Nonflammable.

Exposure: Irritating to eyes, nose, and throat. Symptoms: affects central nervous system, causes anesthesia and peripheral neuropathy. Potent liver toxin. This compound may be carcinogenic.

OSHA PEL: TWA, 100 ppm; ceiling, 200 ppm; max. peak, 300 ppm; 5 minutes in any 3 hours.

ACGIH TLV: WA, 50 ppm; STEL, 200 ppm.

IDLH: 500 ppm.

6.1.11. Trichloroethylene (TCE)

Odor: Sweet; odor threshold, 50 ppm.

Fire Potential: Low fire hazard.

Flammable Limits—LFL 8%, UFL 10.5%.

Explosive Limits—LEL 12.5%, UEL 90%.

Exposure: Irritating to eyes, nose, and throat. Symptoms: nausea, blurred vision, disturbance of central nervous system. Liver toxin. This compound may be carcinogenic.

OSHA PEL: TWA, 100 ppm; ceiling, 200 ppm; max. peak, 300 ppm; 5 min. in any 2 hours.

ACGIH TLV: TWA, 50 ppm; STEL, 200 ppm.

IDLH: 1,000 ppm.

6.1.12. Toluene

Odor: Sweet, pungent, benzene-like odor; odor threshold, 0.17 to 2.1 ppm.

Fire Potential: Flammable liquid ignitable under almost all normal temperature conditions.

Flammable Limits—LFL 1.2%, UFL 7.1%.

Explosive Limits—LEL 1.2%, UEL 7.1%.

Exposure: Irritating to eyes, nose, throat. Symptoms: dizziness, headache, anesthesia.

OSHA PEL: TWA, 200 ppm; ceiling, 300 ppm; max. peak, 500 ppm, 10 min.

ACGIH TLV: TWA, 100 ppm; STEL, 150 ppm.

IDLH: 2,000 ppm.

6.1.13. Tritium (^3H)

Half-Life:

Physical: 12.3 years.

Biological: ~10 days (range: 4–18) total body for HTO.

Special Chemical and Biological Characteristics: Not selectively concentrated in any organ. Metabolized as H_2O . Tritium is assumed to be readily and completely absorbed by the body and to be distributed evenly throughout the body. Tritium is a potential human carcinogen.

Principal Human Metabolic and Dosimetric Parameters:

f_1 (Absorption fraction) = 1.0.

ALI [Allowable life-time intake] (μCi) = 8.1×10^4 (HTO).

DAC (Derived air concentration) ($\mu\text{Ci}/\text{cm}^3$) = 2.2×10^7 (HTO).

6.1.14. Natural and Depleted Uranium

Specific Activity: Natural uranium, 6.6×10^{-7} Ci/g.

Depleted uranium, 3.3×10^{-7} Ci/g.

Sources: Natural uranium is approximately 99.3% uranium-238 by weight.

Depleted uranium is approximately 99.7% uranium-238 by weight.

Exposure: Uranium presents both chemical and radiological hazards, depending upon the amount of enrichment and the chemical form (Table 1). In the case of depleted or natural uranium, relatively soluble compounds present heavy metal toxicity hazards similar to lead. The organ of concern for chemical hazards is the kidney. Relatively insoluble compounds (e.g., high-fired uranium oxides or metals) present chemical/radiological hazards. The organs of concern in this case are the lungs, bone, and kidney.

Table 1. Principal human metabolic parameters controlling uranium hazard.

Compound	Inhalation class ^a	ALI (ingestion) (μCi)	ALI (inhalation) (μCi)	DAC ($\mu\text{Ci}/\text{cm}^3$)	DAC (mg/m^3)	Dominant hazard	ACGHI TLV-TWA (mg/m^3)
Nitrates, fluorides, chlorides, sulfates, acetate, UO_3	D	1.4×10^1	1.4	6.0×10^{-10}	0.8	Chemical	0.2
UF_4 , U_3O_8 , UO_2	W	1.4×10^1	0.81	8.1×10^{-9}	0.4	Chemical/ radiological	0.2
High-fired uranium oxides and metals	Y	1.9×10^2	5.4×10^{-2}	2.0×10^{-11}	0.03	Chemical/ radiological	0.2

^a Inhalation Classes D, W, and Y are as defined in ICRP Publication 30 Part 1, *Annals of the ICRP, Limits for Intakes of Radionuclides by Workers*, 1979, Vol. 2, No. 3/4. In general, Class D compounds are cleared from the lungs in a matter of days, Class W compounds are cleared from the lungs within a few weeks, and Class Y compounds may take years to be cleared from the lungs.

6.1.15. Xylene

Odor: Like benzene; odor threshold, 0.05 ppm.

Fire Potential: Material is flammable and can form explosive mixtures with air.

Flammable Limits	Meta xylene—(XLM):	LFL 1.1%, UFL 6.4%.
	Ortho xylene—(XLO):	LFL 1.1%, UFL 7.0%.
	Para xylene—(XLP):	LFL 1.1%, UFL 6.6%.

Exposure: Irritating to eyes, nose, and throat. Can readily be absorbed through intact skin.
Symptoms: headache, dizziness, and coughing.

OSHA PEL: TWA, 100 ppm.

ACGIH TLV: TWA, 100 ppm; STEL, 150 ppm.

IDLH: 10,000 ppm.

6.2. Biological Hazards

Snake Bite

Rattlesnakes inhabit Site 300 and steps should be taken to protect workers through the use of snake chaps and high-top boots when appropriate. Anyone who has been bitten should be moved to a safe area. The individual should be kept calm. Notify the Emergency Dispatch (**911**) immediately. Arrangements have been established with Tracy Hospital for such an emergency to ensure the availability of antivenom serum.

Valley Fever

All persons who work at or visit Site 300 may be exposed to Valley Fever, a respiratory infection common throughout the San Joaquin Valley. All persons who work at Site 300 will be informed of their possible exposure to Valley Fever. Supervisors are responsible for ensuring that before assigning or hiring an employee to work at Site 300, for a short term or indefinitely, that the employee is referred to Health Services. Health Services will brief the individual regarding Valley Fever. Immunity or lack of immunity can be determined by a simple skin test. Health Services will inform the employee of the health risks associated with Valley Fever and a Site 300 assignment.

6.3. Physical Hazards

Working conditions at the site involve potential exposure to the physical hazards discussed below.

Mechanical Motions and Actions

A wide variety of mechanical motions and actions may present hazards to personnel. These can include the movement of rotating members, include the movement of rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and any part that may cause impact or shear. These different types of hazardous mechanical motions and actions are basic in varying combinations to nearly all machines.

Any machine part, function, or process which may cause injury shall be either guarded (physical barriers which prevent access to danger areas) or safeguarded (provided with devices which inhibit machine operation, to mitigate or eliminate danger areas).

Machine operators shall be trained in the proper use of equipment and associated guards/safeguards to protect themselves and others from machine-related hazards.

Machine operators shall wear protective clothing or personal protective equipment as necessary whenever engineering controls are not available or are not fully capable of protecting personnel. Protective equipment selected shall be:

- Appropriate for the particular hazards,
- Maintained in good condition,
- Properly stored when not in use to prevent damage or loss, and
- Kept clean, fully functional, and sanitary.

As a minimum, safety shoes and safety glasses shall be worn by all personnel operating or working within close proximity of heavy machinery or equipment. When there is a potential for head injury, hard hats shall be worn.

Excavations

Falls into open excavations and/or side wall collapse while personnel are inside the excavation are the major dangers. To minimize these hazards, excavations shall be barricaded and the walls properly sloped or shored according to OSHA requirements before personnel are allowed to enter the excavation. Personnel not directly involved in excavation activities shall remain at least ten feet away from the edge of an excavation. Excavated materials shall be kept at least 2 feet from the edge of the excavation. Plan work in or near excavations carefully and in consultation with the SSO about protective measures and equipment use. Individuals shall be properly trained prior to initiating work activities. See Appendix C for information on trench and excavation safety.

Overhead Power Lines

No equipment shall be operated closer than 15 feet in any direction to overhead power lines. Operation closer than 15 feet may be permitted only when overhead power lines have been de-energized, locked, and tagged out.

Underground Utilities

Site 300 Plant Engineering shall be notified of site activities in order to locate and mark any potentially hazardous underground utilities. In addition, an underground utilities locator supplied by Plant Engineering will identify buried lines prior to drilling.

Confined Space Entry

Although no confined space entries are currently anticipated, employees will be trained in what types of areas might be confined spaces. When entry into a confined space is necessary, Hazards Control will be contacted to obtain a confined space entry permit. The procedures required by the *LLNL ES&H Manual* Supplement 26.14, "Working in Confined Spaces," 29 CFR

1910.146–Permit Confined Spaces, and the ANSI Z117.89, “Safety Requirements for Confined Spaces” shall be followed.

Electrical Hazards

Ignorance of basic electrical principles and misuse of electrical equipment contribute to many accidents. The human body's resistance can be drastically reduced by working with wet tools, in wet or damp locations, inside tanks and boilers, or around metal piping or other grounding materials. Other factors affecting the severity of electrical injuries include the path of the current through the body, the vital organs in that path, and the duration of the current through the body.

There are many ways an employee can come into contact with energized circuits. The most common of these are contact with exposed live parts and overhead or buried power lines. When working in the vicinity of live electrical parts, such as exposed wires, switches, or contacts, the parts must be guarded from contact by effective insulation or other means. If that is not possible, the circuit must be de-energized and visibly grounded.

Pertinent information on electrical safety can be found in the ERD Electrical Safety Policy (Appendix E).

Noise

Noise exposure is primarily associated with heavy equipment, steam cleaning, and air compressors. Based upon previous experience, it is not anticipated that the noise levels will be of concern. Ear protection is provided for all field personnel and its use is encouraged when appropriate. Personnel may also experience impulse noise of up to 140 dB from explosives tests. Sound levels shall be monitored during the above operations and any other operation that generates hazardous noise levels.

Heat Stress

Heat stress is associated with exposure to high temperatures, wearing protective clothing, and physical exertion. Temperatures at the site can exceed 100°F on occasion. Drinking water is available on site and appropriate breaks shall be taken if temperature and levels of personal protection so dictate. Work should be conducted under umbrellas when appropriate to provide shade. Based upon previous experience and work performed at this site, it is not anticipated that heat stress will be a major concern when proper precautions are taken.

Personnel will inform the SSO of any symptoms of heat stress, such as:

- Weakness and fatigue.
- Nausea.
- Dizziness.
- Headache.

The SSO will be alert to signs of heat stress in site personnel and increase the frequency of breaks and fluid consumption as necessary. First aid care may require the following:

- Move victim to a cool environment.
- Loosen victim's clothing.
- If fainting seems likely, have the victim lie down with feet elevated 8 to 12 inches.
- Provide victim with sips of cool water or electrolyte drink such as Gatorade.

- In extreme cases, obtain medical assistance as quickly as possible.

The SSO shall determine the schedule of work and rest periods based on the temperatures at the work site. If there is any question as to the potential for heat stress during operations, the SSO shall contact the ES&H Team 1 industrial hygienist for any evaluation of the operational hazards and controls, including measurement of wet bulb globe temperature index.

Frostbite and Hypothermia

In cold environments, the body's metabolic rate must increase to maintain its thermal balance. Shivering increases the metabolic heat production and yet the feet, face, and hands still may feel cold. This often creates confusion for the exposed individual because he/she may be warmly clothed. Frostbite results from exposure to severe cold. It is more likely to occur when the wind is blowing. The nose, cheeks, ears, toes, and fingers are the body parts most frequently frostbitten. Hypothermia is the general cooling of the entire body.

To prevent frostbite and hypothermia:

- Dress warmly in cotton and wool clothing.
- Initiate work/rest regimens that ensure adequate protection from the cold.
- Drink hot fluids such coffee, tea, or soup.

Finally, obtain medical assistance when there is any doubt regarding the severity of exposure.

Explosives Hazards

Personnel could sustain injuries from blast fragments or heat should they be exposed to an accidental explosion or should they pick up an explosive. Personnel shall be made aware of the hazards involved with handling explosives. When possible, personnel shall remain at least at intraline distance from all explosives storage and operating facilities. Any work necessary within the intraline distance must follow the procedures outlined in Appendix G. Offices shall be at least at the inhabited building distance from all explosives storage and operating facilities.

6.4. General Safety Hazards

Other possible safety hazards include the potential for slipping, falling, head trauma, lifting heavy objects, insect bites, etc. All personnel working on the project will wear appropriate PPE, including eye protection, hard hat, and steel-toed boots as required by the SSO. At a minimum, EPA Level D protection is required. First aid will be available onsite to take care of any minor injuries. Contact Emergency Response Dispatch (911) or from a cell phone (447-6880) in emergency situations more serious than cuts or scrapes.

**Contact Emergency Response Dispatch (911)
or from a cell phone 447-6880 in emergency
situations.**

6.5. Hazards to Non-project Personnel

Potential risks to project personnel have been outlined above. Potential risks to other persons on the site who are not working on this project are exposure to vapors, gases, and chemicals in soil or ground water and the physical hazards associated with heavy equipment.

Air monitoring may be conducted to minimize the possibility of public and personnel exposure to vapors and gases. These procedures are described in Section 8. Due to the open air environment at the site and the fact that the work zone will be barricaded, the risk to the public and laboratory personnel is expected to be negligible.

7. Emergency Actions

7.1. Planning

The SSO shall plan escape routes and discuss them with project personnel before they enter a site to begin work. Initial planning includes establishing the best means for evacuation from the site in case of a catastrophe (e.g., explosion, tank rupture, fire, etc.).

7.2. Emergency Services

A tested system must be in place for rapid and clear distress communications, preferably voice, from all personnel to the emergency response unit of the LLNL Fire Department and the SSO. The SSO shall ensure that all personnel working at the site know how to communicate with the LLNL Emergency Response Dispatch at **911** (Offsite, dial **911**); 447-6880 when using a cell phone. All personnel shall have adequate and clear directions and access to personnel to local emergency services.

7.3. Evacuation

If evacuation is necessary, all personnel will proceed to a predetermined location in the support zone upwind of the work zone.

The predetermined evacuation route and assembly location will be specified at each site. ERD employees and subcontractors will evacuate the work site and not directly assist in handling the emergency.

The signal for evacuation will be three short blasts in succession on an air or car horn.

7.4. Emergency Evacuation From Contaminated Areas

Any person requiring medical attention shall be evacuated promptly from any contaminated area. However, personnel shall not enter an area to attempt a rescue if their own lives would also be threatened because of inadequate personal protection (e.g., oxygen-deficient atmosphere and no self-contained breathing apparatus). Contact the LLNL Emergency Response Dispatch at **911** or 447-6880 when using a cell phone to evacuate any person from any area of the site if necessary and to provide special decontamination treatment or procedures for any injured person. The SSO shall order evacuation of any person whose PPE fails.

7.5. First Aid

Qualified personnel shall give first aid and stabilize any employee needing assistance. Life support techniques such as CPR and treatment of life-threatening problems, such as bleeding, airway maintenance, and shock, shall be given top priority. Professional medical assistance shall be obtained at the earliest possible opportunity. If assistance beyond first aid is required, phone the LLNL Emergency Response Dispatch at **911** or 447-6880 when using a cell phone.

Maintain a first aid kit in the support zone. When drilling, items should be kept in a clean location near or on the drill rig.

Emergency first aid procedures for organic compounds.

Exposure	Procedures
Eyes	Flush eyes immediately with fresh water for at least 15 minutes while holding the eyelids open. Call LLNL Emergency Response Dispatch at 911 immediately.
Skin	Wash skin thoroughly with soap and water. See a doctor if any unusual signs or symptoms or if any skin irritation occurs. Launder contaminated clothing.
Inhalation	Move exposed person to fresh air. If breathing has stopped, apply artificial respiration. Call LLNL Emergency Response Dispatch at 911 immediately.
Ingestion	If swallowed, DO NOT make person vomit. Call LLNL Emergency Response Dispatch at 911 immediately.

7.6. Fire

Call the LLNL Fire Department at **911** or 447-6880 when using a cell phone in the event of any fire. When using a trunked radio call the CAS operator (Mike).

7.7. Hazardous Materials Spill

For spills of hazardous materials greater in volume than one gallon, call LLNL Emergency Response Dispatch at **911** or 447-6880 when using a cell phone. Refer to the appropriate MSDS (see Appendix C) for special instructions regarding cleanup or spills. For any size spill, contact the Environmental Analyst (EA).

7.8. Guidelines

If any emergency involving actual or suspected personal injury occurs, the SSO, work supervisor, and surviving personnel shall follow these steps:

- Remove the exposed or injured person(s) from immediate danger—do not expose survivors to danger.

- Obtain paramedic service or ambulance transport to local hospital by calling the LLNL Emergency Response Dispatch at **911** or 447-6880 when using a cell phone. This procedure shall be followed even if there is no visible injury.
- At the earliest time practicable, the SSO shall contact the Project Leader or designee and Hazards Control, giving details of the incident and the steps taken to prevent its recurrence.
- Other personnel onsite shall be evacuated to a safe distance until the Hazards Control Safety Team determines that it is safe for work to resume.
- A written report of the incident must be forwarded to the Project Leader or designee within 24 hours following the incident.

Subsequent reporting shall be completed according to the requirements of the *LLNL ES&H Manual*, Volume 1, Part 5: Feedback and Improvement.

8. Personal Protective Apparel and Equipment

Suggested item specifications and descriptions in this section are for information only. Equivalent items may be used.

8.1. Personal Protection

The nature of this work is such that several potentially hazardous conditions could be encountered. It is not always possible to determine in advance actual conditions and all protective requirements. Items specified below are intended to allow the SSO the latitude to provide a range of protection based upon actual working conditions. Where feasible, engineering controls in accordance with 29 CFR 1910, Subpart G and work practices are used to prevent exposure of employees to hazardous substances above their PEL or other published exposure limit if no PEL exists. However, when such is not feasible or not required, a reasonable combination of engineering controls, work practices, and PPE will be used. PPE selection is made to protect the employees from hazards or potential hazards at the site in accordance with 29 CFR 1910, Subpart I, Personal Protective Equipment.

The proper use and selection of PPE include consideration of at least the following items:

- A. Proper usage procedure (i.e., donning and doffing).
- B. Equipment limitations (i.e., reduced dexterity, vapor versus liquid contact, hazardous substance and concentration, and temperature).
- C. Anticipated duration of use.
- D. Maintenance and storage requirements.
- E. Decontamination and disposal.
- F. Inspection procedures.
- G. Heat and cold stress, activity levels, and other medical considerations.
- H. Employee training and fitting of equipment.

The use of employee rotation in order to achieve compliance of employee exposures to hazardous substances with PELs is not anticipated and would only be used when no other feasible means is available (i.e., a reasonable combination of engineering controls, work practices, PPE, etc.).

At a minimum, EPA Level D protection shall be worn during investigations at Site 300. It is not expected that higher levels of protection would be required often.

Depending upon the circumstances and the hazards present at a given site, the level of PPE will be determined by the Hazards Control Department. Some of the items recommended for a given level may be modified as appropriate (see Appendix F). The level of protection is selected based primarily upon:

- A. Characteristics of hazardous substances (i.e., toxicity, concentration, entry routes, warning properties, etc.).

- B. The potential for exposure in air, from splashes or from immersion in liquids, or other direct contact with hazardous substances.

Level D consists of a work uniform which provides minimal protection and essentially no protection against chemical hazards. It is used when no inhalation hazard is present nor anticipated to occur during the operations and skin contact with hazardous substances by immersion or splashes is not anticipated.

Many of the following items are only necessary for upgrading to Modified Level C protection. However, the SSO or designee shall ensure that all workers have all the following items available for their use:

- **Gloves**
Inner, surgical type (vinyl disposable)
Outer, chemical protective (neoprene or nitrile)
- **Protective clothing**
Cotton, regular, washable coveralls
AND Tyvek, regular, disposable, zippered coveralls
- **Footwear**
Chemical protective boots (low-temperature vinyl), steel-toed
OR safety shoes worn with protective rubber overshoes
- **Eye protection**
Safety glasses with optional side-shields
OR goggles
OR single unit plastic “specs” with side-shields
- **Hard hat with attachable face shield (optional)**
- **Hearing protection**
Muffs and/or earplugs
- **Respirators**
National Institute for Occupational Safety and Health (NIOSH) approved full face mask air-purifying respirator equipped with a high-efficiency particulate filter (HEPA) with protection for organic vapors, acid gases, dusts, fumes, and mists, asbestos, and radionuclides. The protection for dusts, fumes, and mists shall be furnished for a TWA less than 0.05 mg/m³.

OR NIOSH-approved half-mask air-purifying respirator equipped with a HEPA filter with protection for organic vapors, acid gases, dusts, fumes, and mists, asbestos, and radionuclides. The protection for dusts, fumes, and mists shall be for a TWA less than 0.05 mg/m³.

Conventional eyeglass frames cannot be used with full-face mask respirators because of interference with the face seal. Special eyeglasses can be mounted inside the face mask; however, there is a delay to obtain prescription lenses.

The SSO or designee shall specify which employees are required to wear the items listed above. The SSO or designee shall instruct site personnel to don appropriate respiratory protection when air monitoring results show breathing zone concentrations of benzene greater than 1 ppm, or when total hydrocarbon monitoring results show that protection is warranted. The SSO or designee shall determine which level of personal protective items (gloves, goggles, etc.) is needed, based on professional judgment regarding site conditions and the likelihood of exposure. Respiratory protection should be used if personnel exposure above TLVs is probable, or if personnel desire protection for odor or nuisance mitigation.

Personnel who wear respirators will be trained in their proper usage, have a current medical examination, and have been fit tested within the past 12 months. Facial hair which interferes with the respirator seal must be removed prior to respirator usage (29 CFR 1910.134 and LLNL Respiratory Protection Program).

It should be recognized that the nature of the potential hazards is such that it is not possible to provide maximum protection for all suspected contaminants. If unanticipated conditions are encountered that require additional personnel protection, the SSO or designee shall ensure that appropriate additional personal protective apparel and equipment are in use prior to continuing activities under those conditions.

8.2. Apparel Decontamination

If conditions warrant, the SSO or designee may establish at least one safety apparel decontamination station at the work site in the contamination reduction zone. Decontamination is defined as removing any potentially contaminated soil from boots by washing with soap and water or removing boot covers in the contamination reduction zone upon exiting the work zone.

The location of the decontamination process will be selected to minimize the exposure of uncontaminated employees and equipment to the contaminated employees and equipment. The SSO or designee will monitor decontamination procedures to determine their effectiveness.

In the event that permeable clothing should become wetted with hazardous substances, the employee will immediately remove that clothing and proceed to shower.

If additional PPE is used, such as Polytyvek suits and chemical-resistant gloves, remove them in the contamination reduction zone after leaving the work zone. If this equipment is used, it must be decontaminated or disposed of properly.

8.3. Equipment Decontamination

Soils remaining on tools, sampling equipment, or heavy equipment will be removed by steam cleaning and/or soap and water. If there is reason to believe that the water used for this decontamination procedure requires containment and disposal, it will be contained and properly disposed of based upon analytical results.

8.4. Personnel Decontamination and Personal Hygiene

Personnel may be subject to skin or eye irritation from contaminants. Before eating, drinking, or smoking, site workers should thoroughly wash their hands and other exposed skin surfaces after leaving a contaminated area.

Where regular showers and change rooms are needed for decontamination outside of contaminated areas, they will meet the requirements of 29 CFR 1910.141, "SANITATION." Protective equipment and/or clothing will not be removed from change-rooms by unauthorized personnel.

8.5. Monitoring Equipment

The SSO or designee shall ensure that all necessary monitoring equipment is available in sufficient quantities prior to work initiation. The SSO or designee shall also ensure that these instruments are used only by personnel who have had prior experience with their care, calibration, and operation and who know their limitations. No work shall be done unless this instrumentation is available and in proper working order.

8.5.1. Monitoring Rationale

Monitoring shall be sufficient to determine:

- Airborne concentrations of hazardous chemical substances.
- Combustible gas and oxygen levels.
- Surface contamination of work areas.
- Contamination of personal protective apparel and equipment.
- Personnel contamination.
- Suitability of release of equipment and material to unrestricted areas.

8.5.2. Equipment

The SSO, or designee, may order the use of any or all of the following monitoring equipment to assist in evaluating potential hazards:

- Combustible gas/oxygen meter.
- Passive chemical dosimeters (i.e., 3M Organic Vapor Monitor, Draeger Direct-Reading Diffusion Tubes).
- Other real-time monitoring instruments (i.e., hydrogen sulfide, carbon monoxide, etc.).
- Photoionization detector (PID) or Organic Vapor Meter (OVM).
- Flame ionization detector (FID) or Organic Vapor Analyzer (OVA).
- Hand pump (e.g., Draeger) with colorimetric detector tubes for specific compounds, particularly benzene.

- Constant flow personnel air sampling pumps, which can be calibrated to appropriate volumetric air flow rates to collect airborne samples consistent with NIOSH requirements. The other items required for air sampling include: tubing, filter cassette holders, charcoal tubes, filters, and calibration equipment.
- Radiation detection equipment/monitors.

8.5.3. Initial Monitoring

A preliminary survey of existing air quality is performed by a qualified person to determine the presence of any of the following conditions prior to commencement of operations:

- Immediately dangerous to life and health (IDLH).
- Potential exposure to hazardous substances in excess of PEL or other published exposure limits when applicable.
- Exposure to radioactive substances in excess of established dose limits.
- Exposure to other dangerous conditions (i.e., flammable atmospheres or oxygen deficiency).

The site is initially inspected for visual signs of dangerous conditions and surveyed with appropriate instruments (OVM or OVA) prior to initiation of any work activities to establish background levels for use in proper selection of engineering controls, safe work practices, and PPE. Where radiation is anticipated, the site is also surveyed with radiation detection equipment.

If the presence of other hazardous substances not detectable with the above equipment is anticipated (hydrogen sulfide, carbon monoxide, etc.), the appropriate monitoring equipment will be used to survey the site (i.e., Drager detector tubes, substance-specific monitors, combustible gas/oxygen meter, etc.).

This survey will focus on the following areas:

- The contamination reduction zone upwind from drilling activities, excavation, and other work activities.
- Locations where workers may assemble or congregate.
- Confined spaces or areas where gases may be trapped.

8.5.4. Periodic Monitoring

When the potential for exposure is unknown, periodic monitoring of onsite ambient concentrations of VOCs in the immediate vicinity of work activities will be performed using a OVM or OVA. The SSO or designee will compare monitoring results with OSHA standards, and other exposure guidelines, if monitoring indicates the possibility of exceeding exposure limits. The SSO shall notify the Hazards Control Safety Team to assess the condition.

Where work activities may generate dust contaminated with beryllium or lead, it may be necessary to use a calibrated sampling pump to collect an airborne sample of particulate on a filter. When this is done, samples should be analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory according to NIOSH procedures.

Periodic monitoring shall be performed whenever there is a possibility that an IDLH condition or explosive atmosphere has developed or when an indication that exposure may be in excess of the PEL or other published exposure limits. When any of following situations exist, additional precautions shall be considered:

- Initiation of work in a different portion of the site.
- If new contaminants are known to be, or suspected of being present.
- When employees are handling leaking containers or working in areas with obvious contamination.
- Upon initiation of a different type of operation.

8.5.5. High Risk Employees

The employees who are most likely to be exposed to hazardous substances above the PEL or other applicable published exposure limits will be monitored first. If they are being exposed to levels above the PEL, then monitoring will be performed to establish which other employees, if any, may also be exposed above the PEL.

8.5.6. Perimeter Monitoring

Under certain circumstances, it may be necessary to conduct perimeter monitoring to evaluate emissions resulting from work covered by this SSP. If such monitoring is conducted and results are higher than baseline levels of any contaminant, immediate steps will be taken to determine the cause, make changes to site operations, evacuate unprotected personnel and the public, if necessary, and notify agency contact personnel. Specific protocols to be implemented shall be determined by the SSO and the Project Leader for each incident.

8.6. First Aid and Safety Equipment

To provide first response assistance to field personnel in the event of an injury or illness, the SSO or designee shall have the following items immediately available at the site investigation command post, or at work areas, as appropriate:

- First aid kit.
- First aid handbook.
- Portable emergency eyewash station or bottles.
- Supply of clean water.
- Hand soap, or waterless hand cleaner, and clean hand towels.
- Portable cooler with drinking water (or replenishment drink such as Gatorade) and ice.

9. Personnel Training

Individuals assigned to this project who may be exposed to physical and chemical hazards shall undergo training to:

- Ensure that the health and safety of LLNL employees, contract employees, employees or representatives of other agencies, and the public is maintained.
- Safeguard the health and safety of all employees and the public by complying with all laws, rules, and regulations.
- Increase the ability of employees to react responsibly to emergencies and to handle emergency situations in a safe manner.
- Increase the ability of employees to complete their work in an efficient and timely manner.

9.1. Hazardous Waste Operations and General Safety Requirements

All personnel working on ERD cleanup sites at LLNL who may be exposed to physical and chemical hazards shall attend 40 hours of health and safety training, 24 hours of on-the-job field training under supervision, or other combinations deemed equivalent by the SSO, as specified in OSHA 29 CFR 1910.120. Personnel will be trained prior to their participation in field activities and written certificates are to be issued upon successful completion of that training. The Project Leader, SSO, and supervisors are required to complete an additional eight hours of "Hazardous Waste Supervisors" training. All site personnel are required to complete eight hours of "Refresher" training annually.

Instructors shall have completed a training program for the subjects that they are expected to teach or have academic credentials and instructional experience for teaching the subjects.

The above requirements address minimal training needs and additional training will be provided as deemed appropriate.

At a minimum, worker training should address the following topics:

- Names of personnel and alternates responsible for site health and safety.
- Onsite Medical Surveillance and Signs of Overexposure.
- Elements of the SSP and any applicable OSP.
- Program Discussion/Regulatory Overview.
- Training Rationale.
- Chemical and Physical Hazards.
- Toxicology.
- Medical Surveillance Program.

- Environmental Planning
 - Hazards Analysis
 - Work Plan
 - Site Safety Plan.
- Characterization and Site Activities.
- Site Control.
- Personal Protective Equipment
 - Clothing
 - Respirators and Fit Testing.
- Air Monitoring.
- Decontamination.
- Emergencies.
- Site Operations.
- Hazardous Substance Identification.
- Hazard Communication Program.

9.2. Work Site Specific Topics

All site personnel (LLNL employees and contract) shall attend a site-specific training session which addresses: nature and degree of exposure anticipated at the site; prohibited practices; emergency procedures; site-specific safety requirements; and general safety requirements.

9.2.1. Prohibited Practices

The following practices must be strictly observed at all times during the project work. The prohibitions shall remain in effect from the time of entry into the work site until after leaving that portion of the site. They include:

- Eating, chewing, drinking, or use of tobacco products will not be allowed past the Contamination Control Line (i.e., “Hotline”). Avoid all hand-to-mouth contact when your clothing or body may be contaminated (i.e., be careful until after showering). Any open wounds must be covered with an air-tight bandage; ideally, someone with an open wound should not enter a work site. Persons with lesions or sores in the mouth, eyes, or nose shall not enter the work site.
- Never climb over or under any refuse or obstacles.
- Facial hair that may interfere with the satisfactory fit of respiratory protective equipment will not be allowed. Workers with beards will not be allowed to do work requiring respiratory protection.
- Personnel may not wear loose, ragged, or poorly fitted clothing, dangling jewelry, or rings when working around equipment or tools. Long hair must be restrained so that it does not

get caught in moving parts. Any of these items can become snagged in moving equipment and result in serious injury.

- Alcohol and/or drugs are not permitted at the site. Any person reporting to work under the influence of alcohol and/or illegal drugs will be permanently prohibited from working at the site.

The following prohibitions and practices shall be in effect when deemed necessary by the SSO due to the existence of hazardous conditions at the work area:

- Do not wear contact lenses. Eye contamination while wearing contact lenses can result in serious injury to the eye before the lens can be removed and the eye properly washed.
- Practice contamination avoidance: never sit down or kneel, never place equipment on contaminated surfaces, avoid obvious sources of contamination such as puddles, avoid unnecessary contact with on-site objects.
- Do not start or maintain an open flame of any type unless authorized.
- No employee may enter a work site alone or work alone without prior approval. Special work tasks, such as water level measurements or water sampling, may require that an individual work alone. In such cases, procedures shall be developed delineating emergency response and communication activities and responsibilities.

In addition to the prohibitions and practices listed above, the SSO may impose any other prohibitions that may be required for safe operations.

9.2.2. Emergency Procedures and Services

The training session should include:

- LLNL Emergency Response Dispatch (**911**).
- Signals, alarms, and hazard signs.
- Evacuation routes and procedures.
- Assembly points.
- Buddy system.
- Communications.
- Fire protection.
- Barricades and scaffolds.
- Emergency equipment.
- First aid and contaminated wounds.
- Spills.

Refer to page 1 of this document for emergency telephone numbers and Section 7 of this document for emergency procedures.

9.2.3. General Safety Requirements

All project work shall be performed in a manner consistent with providing a safe work environment. General safety guidelines are to:

- Wear appropriate protective clothing for the job, including, but not limited to, hard hat, work clothing, safety shoes, and eye protection.
- Decontaminate known sources of contamination (such as gloves and boots) at the appropriate location as specified by the SSO. Remove equipment only after decontamination or containerization onsite.
- Keep track of weather conditions and wind direction when working outside.
- Plan activities thoroughly ahead of time: enter work sites by a designated route only to get to a designated point for a specific purpose.
- Always use the buddy system: never enter or exit alone, and never work alone in an isolated area.
- Always maintain contact with the SSO and the ERD offices (T-8726), where site access and operations are controlled.
- Shower thoroughly as soon as possible after removing protective equipment.
- Wash hands thoroughly upon leaving any area of suspected contamination.
- All personal safety equipment is to be inspected prior to work site entrance. The condition of the equipment must be acceptable to the SSO.
- All personnel who will enter a work site should wear secure identification (e.g., badge with photo and name; name on clothing). A name on the hard hat is not secure identification. Identification must be visible even when all PPE or gear is worn.
- Never assume that a situation is as safe as it appears to be.
- Be alert to any unusual behavior on the part of other workers that might indicate distress, disorientation, or other ill effects. Be alert to any unusual changes in your own condition; never ignore warning signs or hesitate to report them at once. Inform each other of symptoms of nausea, dizziness, headache, or respiratory or eye irritation.
- Maintain a clean and organized work area.
- Delineate work zones with barricades and markers.
- Label raw materials, debris, scrap, waste, intermediates, and contaminated clothing with appropriate and understandable precautionary labels.
- Post warnings in areas with high noise levels and require PPE.
- Inspect fire extinguishers monthly for adequate pressure.
- Only trained and experienced operators are to operate heavy equipment onsite.

9.3. Field Briefings

The SSO, or designee, shall conduct daily health and safety field briefings that include:

- Work activities that day.
- Health and safety requirements for that day.
- Work zones.
- Evacuation routes.
- Assembly point upwind of work area, in case of emergency or evacuation.
- Emergency signals.
- Location of first aid and emergency safety equipment.

9.4. First Aid

The SSO, or designee, shall identify those individuals who have previously completed training programs in First Aid and CPR. These individuals should be appointed as alternates for the SSO if he/she is incapacitated or needs assistance. Specific responsibilities will be assigned to these individuals by the SSO, who will take into consideration their familiarity with the following topics:

- Principles of first aid.
- Restoration of breathing/CPR.
- Control of bleeding.
- Recognition and treatment of physical shock.
- Open and closed wounds and burns.
- Fractures and dislocations.

10. Operations

Operations shall be conducted in a safe manner consistent with the policies and procedures outlined in this SSP. The number of personnel shall be restricted to the minimum necessary to complete the required work as an administrative control to limit the exposure of personnel to hazards onsite.

10.1. Work Site Practices

The prohibited practices and general safety requirements listed in Section 9 are applicable to this site work. In addition, no worker may engage in any activity for which the health and safety consequences of his/her actions are unclear (e.g., previously unplanned work) without the approval of the SSO. If such activities become necessary to complete any phase of the work, a project instruction or procedure shall be developed and followed.

Smoking will not be permitted in any restricted work location or other locations posted "No Smoking" by LLNL.

10.2. Work Zones

Site access shall be controlled to reduce the possibility of entry by unauthorized or unprotected individuals and prevent the transfer of contaminants by personnel or equipment from the site. Three zones, the exclusion zone, the contamination reduction zone, and the support zone, will be delineated by barricades and flagging as appropriate. Zones will be established by the SSO or designee based on local conditions. In most situations, such as during drilling operations in small, individual areas, only a barrier delineating the exclusion zone and the support zone will be needed.

The SSO or designee will be alert to persons entering active zones and will prohibit unauthorized or unprotected persons from entering these zones. Zones may be modified or expanded by the SSO depending upon changing wind and site conditions.

10.2.1. Exclusion Zone

The exclusion zone shall include, at a minimum, the immediate vicinity of the work area (such as the drill rig and the boring location at the rear of the rig) plus an additional 15-foot corridor. Persons entering this zone are required to wear PPE as prescribed by the SSO for that particular zone.

10.2.2. Contamination Reduction Zone

The contamination reduction zone shall be located upwind of the exclusion zone. The purpose of this zone is to prevent the transfer of contaminants by personnel or equipment exiting the exclusion zone. All decontamination activities shall occur in this area.

In the case of drill rig activities, a separate contamination reduction zone may not be necessary. It will usually suffice to establish a decontamination point at the entrance/exit to the barricade

around the drill site. Personnel may discard any contaminated articles before stepping outside of the barrier into the support zone (the remainder of the site).

10.2.3. Support Zone

The support zone is the outermost zone and is considered a noncontaminated (or clean) area. Any supplies, equipment, or personnel required to support site activities should be kept in this zone. The support zone shall be upwind of the contamination reduction and exclusion zones.

10.3. Security Measures

All areas and containers where potentially contaminated soil or water are to be stored unattended and any excavations that are to be left open and unattended are to be surrounded by a barricade to prevent accidental access by unauthorized personnel. Potentially contaminated material shall be properly packaged and labeled.

10.4. Hazard Control Measures

Specific considerations shall be given to the following topics to ensure that adequate hazard control measures are implemented for site operations:

- Minimization of dust generation (e.g., applying water when excavating or drilling).
- Prevention of surface contamination by subsurface material or vice versa.
- Decontamination of sampling equipment.
- Decontamination of excavation/construction/maintenance equipment.
- Decontamination and disposal of personnel protective apparel and equipment.
- Use of decontamination solutions—acids, alkalis, or solvents.
- Disposal of decontamination solutions and other materials used on equipment, surfaces, or systems.
- Disposal of drilling spoils and other wastes associated with environmental characterization.
- Disposal of contaminated materials by placing them in 55-gallon drums, which may be sealed, labeled, and disposed of as necessary.
- Monitoring for flammable/explosive vapors.
- Minimization of personnel exposures through appropriate use of administrative work practices.
- Handling and disposal of contaminated water, filtrates, etc.
- Use and operation of electrical equipment (see Appendix E).
- Use and maintenance of personnel protective apparel and equipment.
- Trench and excavation safety (see Appendix D).

- Personnel air monitoring protocols for evaluation of full-shift and short-term chemical exposures.
- Direct reading instrumentation protocols and techniques for estimating real-time chemical exposures onsite.
- Respiratory protection as per 29 CFR 1910.134 and ANSI Z88.2.

The Hazards Control Department, Safety Team Four, can be contacted for guidance and evaluation.

10.5. Fire Protection

To ensure that fire and explosion hazards are minimized, plans and procedures must be coordinated with the LLNL Fire Department (911). If suitable water supplies are unavailable or where water use may be inappropriate, 20- or 30-lb ABC fire extinguishers may be necessary for each drill rig or field crew. No smoking is allowed in the work area nor near any flammable materials. Any use of open flame requires prior authorization by the SSO.

Employees are informed of the fire hazards of the materials and processes to which they are exposed. Upon initial assignment, each employee will be trained in the portions of the fire prevention plan that will protect the employee in the event of an emergency.

The hazardous work sites at LLNL have the fire hazards typical of construction sites and chemical treatment facilities such as: combustible and flammable materials, potential for explosive atmospheres, occasional welding and open flames, oxidizers, and motor fuels.

The LLNL Fire Department and the SSO or designee are responsible for the maintenance of any fire prevention and suppression systems or equipment used on the hazardous work sites.

The accumulation of flammable and combustible waste materials will be minimized as a means of fire prevention.

10.6. Communications

The SSO or designee shall maintain contact with workers on a continuing basis. Individuals shall meet and register at the checkpoint established by the SSO prior to work site entry. Each worker shall ensure that he maintains contact with other workers or his "buddy." No individual may either enter or leave the work site alone. Exiting workers shall inform the SSO, or designee, that they are departing.

10.7. Personnel Protection Plan

Environmental operations pose unusual health and safety problems. A very careful review of OSHA and EPA regulations, standards, and guidelines by the SSO is important. At a minimum, these requirements may include:

- Medical surveillance.
- Personnel exposure monitoring program.
- Respiratory protection.

- PPE and clothing.
- Prohibited activities.
- Compliance program.
- Hygiene facilities and practices.
- Employee information and training.
- Recordkeeping.

10.8. Safety

The industrial health and fire safety aspects of this program will focus on evaluation of hazards associated with:

- Transportation equipment.
- Material handling equipment.
- Machinery and parts.
- Hand tools and pressurized equipment.
- Hazardous supplies and materials.
- Fire protection.
- Electrical equipment (i.e., motors, relays, and starters).

Prior to the initiation of work and weekly thereafter, safety inspections will be conducted by the SSO or designee. This inspection will include those activities necessary to ensure the safe operating condition of all equipment consistent with 29 CFR 1910 and 1926 and the *LLNL ES&H Manual*. Additionally, it will be the responsibility of LLNL's subcontractors to provide a routine maintenance program for their equipment.

10.9. Recordkeeping

Health and safety records shall be maintained in accordance with applicable regulatory requirements. Records are maintained for LLNL personnel at the LLNL Environmental Protection Department offices: these records document safety training, medical surveillance, respiratory protection training and testing, injuries, and illnesses. All subcontractors working on the project are required to maintain similar records at their respective offices.

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Respiratory Protection, U.S. Environmental Protection Agency (EPA Order 1440.3).

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Appendix A

Site-Specific Operational Safety Procedures

Appendix A

Site-Specific Operational Safety Procedures

The Site-Specific Operational Safety Procedures (OSPs) supplements the LLNL Site 300 Safety Plan (SSP) and provides detailed information for a specific operation not fully addressed in the SSP. A copy of the OSP shall be kept at the work site at all times. The OSPs typically includes the following items as applicable and any additional items deemed necessary:

- A. Hazard Assessment For Each Task in Work Plan.
- B. Personal Protective Equipment For Each Task.
- C. Type and Frequency of Air Monitoring.
- D. Site Control Measures.
- E. Decontamination Procedures.
- F. Spill Containment Program.
- G. Employee Training Assignments.
- H. Confined Space Entry Procedures.
- I. Emergency Response Procedures.
- J. Site Inspections.
- K. Medical Surveillance.
- L. Pre-Entry Briefing.

Appendix B

Acronyms

Appendix B

Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ALARA	As low as reasonably achievable
ALI	Annual limit on intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPR	Cardiopulmonary resuscitation
DAC	Derived air concentration
DOE	Department of Energy
DTSC	California Department of Tox Substances Control
EA	Environmental Analyst
EPA	Environmental Protection Agency
ERD	Environmental Restoration Program and Division
ES&H	Environmental Safety and Health
FID	Flame Ionization Detector (OVA)
f_1	Alternative gastrointestinal-tract absorption factor
HE	High explosives
HEPA	High efficiency particulate filter
IDLH	Immediately dangerous to life or health concentration which represents the maximum level from which one could escape within 30 minutes without any escape-impairing symptoms or any other irreversible health effects.
ISM	Integrated Safety Management
IWS	Integrated Work Sheet
LEL/UEL -	Lower and upper explosive limits. Percent by volume of potentially explosive substance in air.
LFL/UFL -	Lower and upper flammable limits. Percent by volume of potentially flammable substance in air.
LLNL	Lawrence Livermore National Laboratory
MSDS	Material Safety Data Sheets
NIOSH	National Institute for Occupational Safety and Health.
OSHA	Occupational Safety and Health Administration.
OSPs	Operational Safety Procedures

OVA	Organic Vapor Analyzer
OVM	Organic Vapor Meter (PID)
PEL	Permissible exposure limit set by OSHA. Values usually are expressed in ppm or mg/m ³ . PELs are expressed as: <ol style="list-style-type: none">(1) 8-hr TWA exposure limit(2) Ceiling exposure limit: at no time shall an employee's exposure exceed this limit(3) Short-term exposure limit (STEL)(4) Maximum peak: acceptable above the specified ceiling limit for the stated concentration and duration.
PID	Photoionization detector (PID)
PPE	Personal protective equipment
QA	Quality Assurance
QAMP	Quality Assurance Management Plan
QAPP	Quality Assurance Project Plan
QIF	Quality Improvement Form
RCRA	Resource Conservation and Recovery Act
RI	Responsible Individual
SOP	Standard Operating Procedure
SSO	Site Safety Officer
SSP	Site Safety Plan
TLV	Threshold limit value as issued by ACGIH. Values usually are expressed in ppm or mg/m ³ . TLVs are expressed as: <ol style="list-style-type: none">(1) TLV-TWA: the TWA concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.(2) TLV-STEL: the 15-min TWA to which a worker can be exposed for a period of up to 15 minutes continuously without suffering from irritation, chronic or irreversible tissue damage, or narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue, or materially reduce worker efficiency, and provided that the daily TLV-TWA is not exceeded.
TWA	Time-weighted average. This is generally expressed as an 8-hour TWA.
VOCs	Volatile organic compounds
WSS	Work Smart Standard

Appendix C

Material Safety Data Sheets

Appendix C

Material Safety Data Sheets

Chemical Hazards

- Benzene
- Beryllium
- Diesel Fuel No. 2
- Gasoline
- HMX
- Hydrochloric Acid
- Hydrosulfurized Kerosine
- Lead
- Nitric Acid
- RDX
- Tetrachloroethylene
- Trichloroethylene
- Toluene
- Tritiated Water
- Tritium
- Depleted Uranium
- Natural Uranium
- Xylene

The following pages are available in paper copy only.
Contact the Environmental Restoration Division at 925/424-6783.

Appendix D

Trench and Excavation Safety

**The following pages are available in paper copy only.
Contact the Environmental Restoration Division at 925/424-6783.**

***Trench and Excavation Safety*
(Chapter XVII—Occupational Safety and Health
Admin. (pgs 201–207))**

Appendix E

Electrical Safety

Appendix E

Environmental Restoration Division

Electrical Safety Policy

E-1. Scope

This policy applies to electrical work performed by Environmental Restoration Division (ERD) personnel on ERD projects and facilities. For the purposes of this policy, ERD personnel includes ERD employees, LLNL employees matrixed to ERD, ERD supplemental labor employees and subcontract employees. This policy is not intended to apply to Plant Engineering Construction Maintenance and Operations (M&O) personnel.

Several Laboratory policies are already in place that address the general issues of electrical safety (see reference list). ERD personnel are strongly encouraged to become familiar with and follow the policies set forth in these documents. This policy is not intended to invalidate or supersede these existing documents. Rather, this policy seeks to address certain areas of ERD operations that require particular consideration.

E-2. Areas of Consideration and Related Policies

Five specific areas of consideration have been identified. These are described below, along with their related policy statements.

E-2.1. Promotion of Safety Awareness and Safe Working Practices

A strong commitment to a safe working environment must be continually reinforced. ERD managers and supervisors must regularly promote the importance of safety awareness and safe working practices.

E-2.1.2. Policy

1. All standing meetings relating to ERD laboratory and field operations shall include a safety discussion as a permanent agenda item. A few minutes at the beginning of all such meetings shall be devoted to general safety and relevant specific safety topics.
2. Managers and supervisors involved in laboratory and field operations shall schedule periodic meetings devoted entirely to safety topics.
3. ERD personnel shall be encouraged to raise safety issues and make specific safety suggestions. The responsible manager or supervisor must address each issue raised.

E-2.2. Unfamiliar Personnel Performing Work in and Around Potentially Live Electrical Enclosures

Work is occasionally performed in and around potentially live circuits by non-ERD personnel. Typically, such work is initiated by someone within ERD.

E-2.2.1. Policy

1. Lock and tag procedures shall be carried out by a responsible ERD person, who must be up to date with Lock and Tag Procedures (HS5245). The non-ERD person who will be performing the work shall observe the lock and tag procedure, double check that power has been removed, and then apply a separate, additional lock that is under their control.

E.2.3. Installation and Wiring of Extraction Well Pumps

Non-electrical ERD personnel are sometimes required to connect an extraction well pump to a power source .

E-2.3.1. Policies

1. ERD personnel performing well pump connections must be up to date on Electrical Hazards Awareness (HS5220), Capacitor Safety (HS5210), Lock and Tag Procedure (HS5245), and Cardiopulmonary Resuscitation (HS6140).
2. If the power source is a utility-supplied AC power line, proper lock and tag procedures shall be carried out by the responsible ERD person. If the power source is a generator, the responsible ERD person shall ensure that the generator is not running, with its circuit breaker switched off, during the well pump connection.
3. Proper connections shall be verified prior to removing the lock and tag, or starting the generator. Proper grounding should receive particular scrutiny.

E-2.4. Inadequate, Obsolete, or Missing Electrical Drawings and Labels

Up to date, accurate drawings are essential to work safety assurance. Proper and accurate labeling can reduce the potential for mistakes.

E-2.4.1. Policies

1. An accurate and complete electrical drawing set shall be maintained, with a copy available at each permanent ERD location at all times.
2. All electrical circuits shall be labeled with the location and identification of its proper lock and tag circuit breaker.
3. All terminals containing voltages 50 V shall be labeled with a warning sign that includes an indication of the voltage present.

E-2.5. Electrical Hazards in Confined Spaces***E-2.5.1. Policies***

1. ERD personnel entering the confined space vault must be up to date with Confined-Space Entry (HS4150) and must observe the requisite procedures for confined space entry. This includes a full understanding of the electrical hazards present in the vault.

2. ERD personnel shall *never* enter a confined space vault when standing water is present *unless* all electrical service to the vault has been de-energized, with the proper lock and tag procedures carried out by the responsible ERD person.

E-3. References

Electronics Engineering Department Electrical Safety Policy, LED 61-00-01-AIA, January 1, 1986.

LLNL **ES&H** Manual, Chapter 23, *Electrical Safety*, February 1996.

LLNL **ES&H** Manual, Chapter 26, *Hazards - General and Miscellaneous*, November 1992.

LLNL **ES&H** Manual, Supplement 26.13, *General Lockout and Tagout Procedure*, September 1990.

DOE Electrical Safety Guidelines, DOE/ID 10600, May 1993.

**The following pages are available in paper copy only.
Contact the Environmental Restoration Division at 925/424-6783.**

***Electrical Safety*
(Chapter XVII—Occupational Safety and Health
Admin. (pgs 125–154))**

Appendix F

Levels of Personal Protection

Appendix F

Levels of Personal Protection

LEVEL A—To be selected when the greatest level of skin, respiratory, and eye protection is required.

Level A equipment; used as appropriate.

1. Pressure-demand, full face-piece self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
2. Totally encapsulating chemical-protective suit.
3. Coveralls.*
4. Long underwear.*
5. Gloves, outer, chemical-resistant.
6. Gloves, inner, chemical-resistant.
7. Boots, chemical-resistant, steel toe and shank.
8. Hard hat (under suit).*
9. Disposable protective suit, gloves and boots (Depending on suit construction, may be worn over totally encapsulating suit).
10. Two-way radios (worn inside encapsulating suit).

*Optional, as applicable.

LEVEL B—The highest level of respiratory protection is necessary, but a lesser level of skin protection is needed.

Level B equipment; used as appropriate.

1. Pressure-demand, full-face piece self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA (NIOSH approved).
2. Hooded chemical-resistant clothing (coveralls and long-sleeved jacket; coveralls; one or two-piece chemical-splash suit; disposable chemical-resistant coveralls).
3. Coveralls.*
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical resistant.
6. Boots, outer, chemical-resistant steel toe and shank.

7. Boot-covers, outer, chemical resistant (disposable).*
8. Hard hat.
9. Two-way radios (worn inside encapsulating suit).
10. Face shield.*

*Optional, as applicable.

LEVEL C—The concentrations(s) and type(s) of airborne substance(s) is known and the criteria for using air purifying respirators are met.

Level C equipment; used as appropriate.

1. Full-face or half-mask, air purifying, canister equipped respirators (NIOSH approved).
2. Hooded chemical-resistant clothing (coveralls; two-piece chemical-splash suit; disposable chemical-resistant coveralls).
3. Coveralls.*
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical resistant.
6. Boots, outer, chemical-resistant steel toe and shank.*
7. Boot-covers, outer, chemical resistant (disposable).*
8. Hard hat.
9. Escape mask.*
10. Two-way radios (worn under outside protective clothing).
11. Face shield.*

*Optional, as applicable.

LEVEL D—A work uniform affording minimal protection: used for nuisance contamination only.

1. Coveralls.
2. Gloves.*
3. Boots/shoes, chemical-resistant steel toe and shank.
4. Boots, outer, chemical-resistant (disposable).*
5. Safety glasses or chemical splash goggles.*
6. Hard hat.
7. Escape mask.*
8. Face shield.*

*Optional as applicable.

The types of hazards for which levels A, B, C, and D protection are appropriate are described below:

Level A protection should be used when:

1. The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin,
2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible, or
3. Operations must be conducted in confined, poorly ventilated areas and the absence of conditions requiring Level A have not yet been determined.

Level B protection should be used when:

1. The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection.

NOTE: This involves atmospheres with IDLH concentrations of specific substances that do not represent a severe skin hazard; or that do not meet the criteria for use of air-purifying respirators.
2. The atmosphere contains less than 19.5 percent oxygen, or
3. The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.

Level C protection should be used when:

1. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin,
2. The types of air contaminants have been identified, concentrations measured, and a canister respirator is available that can remove the contaminants, and
3. All criteria for the use of air-purifying respirators are met.

Level D protection should be used when:

1. The atmosphere contains no hazard, and
2. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

NOTE: As stated before combinations of personal protective equipment other than those described for Levels A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.

Appendix G

DOE Explosives Safety Manual Waiver

DOE EXPLOSIVES SAFETY MANUAL WAIVER

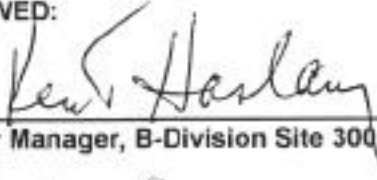
LLNL WAIVER NO: 00-07

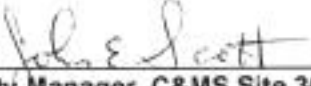
Issued: 05/01/2000


Expires: 04/30/2003


1. **Operation, Area or Building Involved:** Explosives Facilities at Site 300
2. **Responsible Supervisor:** John J. Greci
3. **Specific Standard Requiring Waiver:** Section II, Paragraph 3.2c, states that "Maintenance or construction operations performed by non-DOE facility personnel.... should be at least intraline distance from any building containing explosives."
4. **Description of Condition Not in Compliance:** Non-DOE Contractor personnel will be routinely conducting Environmental Restoration Division (ERD) activities, sampling of wells, etc., within intraline distance of various facilities containing explosives throughout Site 300.
5. **Alternate Safety Measures Existing or Proposed:** Non-DOE contractor personnel shall attend HS-2080, Explosives Safety Orientation for Crafts, Protective Force Division and Fire Personnel before they are allowed to conduct ERD environmental activities within intraline distance of buildings containing explosives. When non-DOE contractor personnel must enter the Process Area, Chemistry Area, Weaponization Test Areas, East or West Firing Areas, Waste Treatment Area or work near any magazine or facility containing explosives, the contractor shall notify the ERD Sampling Coordinator or ERD Site Safety Officer (SSO). The Sampling Coordinator or SSO will contact the appropriate Site 300 Explosives Area and/or Facility Supervisor and request access to the area. The Site 300 Area /Facility Supervisor may grant access to the area and allow non-DOE contractor personnel to conduct ERD environmental operations within intraline distance of their explosives facilities provided no explosives operations are to be done while the ERD environmental work is taking place. Non-DOE contractor personnel shall leave the area within intraline distance of an explosives facility prior to any explosives operations being started. If it becomes necessary to conduct explosives operations while ERD environmental activities are taking place, the specific Site 300 Area/Facility Supervisor shall be responsible for clearing the area of non-DOE contractor personnel.
6. **Why Compliance Will Not Be Reached:** There are many ground water monitoring wells within intraline distance of various explosives operating and storage facilities throughout Site 300. Compliance with the advisory requirements in the DOE Explosives Safety Manual would require all explosives to be removed from each explosives facility prior to ERD environmental activities within intraline distance of that facility. Site 300 does not have the storage capacity (facilities) that would permit the removal of the explosives from the affected buildings. Strict compliance with the alternate safety measures should reduce the chances of a serious incident to an acceptable level.
7. **Risk Assessment:** The probability that an incident will occur based on non-compliance with the advisory requirements in the Explosives Safety Manual is low. The maximum credible event would be a detonation of 25,000 pounds of 1.1 explosives. Death or serious injury to personnel within the intraline distance of the detonation could occur from fragments, debris, firebrands, or other objects.
8. **Other Comments:** Replaces Waiver 97-12-2

REVIEWED:

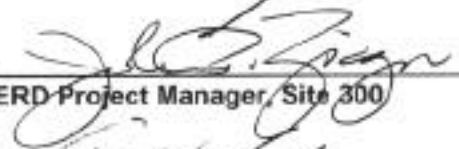

Facility Manager, B-Division Site 300

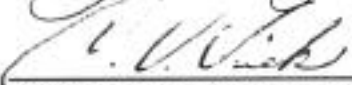

Facility Manager, C&MS Site 300



Operations Manager, C&MS Site 300


Facility Manager, DTED Site 300


Facility Manager, MM Site 300


ERD Project Manager, Site 300


Explosives Safety Engineer


EH&S Team 1 Leader

CONCUR:


Site 300 Manager

APPROVED:


Associate Director:


ADDITIONAL REVIEWS:

LLNL WAIVER NO: 00-07

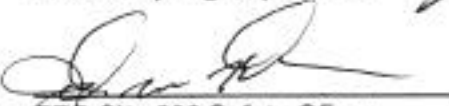

Firing Table Supervisor


Firing Table Supervisor


Chemistry Area Supervisor


DTED Supervisor


ERD Sampling Supervisor


ERD Site 300 Safety Officer

cc:
ES&H Team 1 Explosives Safety (Original)
DOE Oakland/LSOD/L-293
Each signatory